VOL. XII **TEXTILE RESEARCH** NO. 12

Outstanding Features in

This Month's Issue

Jute and Manila Fibers

Described in detail are four practical substitutes for much needed jute and manila fibers. These are adapted to cultivation in the United States. (See page 2.)

Central Research Laboratory

Results obtained by the research laboratory of United Merchants and Manufacturers Management Association has demonstrated the value of unique set-up. (See page 8.)

More Production From Cards

The function of the cotton card should not be considered as part of the cleaning process. Properly prepared cotton will permit greatly increased production. (See page 18.)

Fabrics for War

Research has equipped the fabrics of war with chemical "amor" enabling them to resist fire, water, arctic cold and tropical sun. (See page 22.)

Postwar Full Employment

Arthur Besse in letter to the editor takes issue with Prof. Alvin H. Hansen's "After the War—Full Employment." (See page 30.)

Four Types of Fibers are Suggested As Best Substitutes for

Jute and Manila Fibers

By A. C. WHITFORD, Ph.D.*

DUE TO THE SCARCITY of certain types of fibers such as manila hemp for rope, and jute for burlap and other coarse bagging, it seems right and proper that an investigation should be made of the best available substitutes. In making such a survey certain factors should be borne in mind, among which are ease of production, amount of yield, length of time before production can begin, their adaptability to replace manila and jute, their physical and chemical properties, and whether they can be adapted to mass production by machinery or whether hand labor will be necessary.

Viewing the fiber field it would be possible to consider innumerable fiber plants, but in this article it is felt best to limit the discussion to four. These have been used for a long time, are known to have very desirable qualities, and are adapted to production in the United States. These four are, *Sansevieria, Hibiscus esculente* (okra), *Hibiscus cannabinus,* and *Urena Lobata.* The first two are coarse rope fibers and the second two are finer jute-like materials.

Sansevieria

Only two of the numerous species of Sansevieria have been grown to any extent in this country and they are *zeylanica* and *guineensis.* The first is known as bow-string hemp and the second as Guinea bow-string hemp.

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The Sansevierias are native to Africa and parts of Asia but have been introduced into all parts of the tropical and sub-tropical world and have been produced as fiber plants for centuries in various countries. The Sansevieria has been used as a source of fiber for rope and the finer grades as a raw material for the manufacture of fine cloth. In India it is known as Moorva. Its use is well known and the fiber is much prized where best known.

This fiber bears the closest resemblance in its properties to manila hemp of any of the well known fibers. Its tensile strength is approximately the same and its ability to withstand salt water without deterioration is equal to that of manila. It has been used by rope manufacturers and they report that it can be utilized without any serious changes in their equipment and will need no specially skilled operators.

In the United States it is adapted to the climate in lower east and west coasts of Florida where it grows almost as a weed and after once becoming established needs little if any serious cultivation or fertilization. It covers

Sansevieria zeylanica

Sansevieria guineensis

the ground completely and leaves no space for weeds. It is planted from root cuttings or from leaf cuttings. If the roots are used it should come into production in 18 months and at the end of two years a full crop should be secured. It does best on a sandy soil without too much organic matter and it is estimated that at least two cuttings can be made per year. Each cutting should produce 1600 pounds of fiber or approximately 3200 pounds of usable fiber should be produced per acre each year.

The bow-string hemps all come from the leaves of the plant and vary in length from four to nine feet. The leaves can be run through specially built decorticators for leaf fibers. Many experiments have been carried out on leaf fibers and it seems certain that at least one satisfactory machine has been perfected. In some instances reconstructed sisal machines have been used with reasonable success. Since the fiber lends itself to mass production and can be grown in the United States, it seems well worth investigating and developing.

Okra

Hibiscus esculente (okra) is a plant which is known as a vegetable, producing the pod which is famous in gumbo soups. It also possesses a well worth while fiber of the manila hemp, sisal class. During the first world war a considerable acreage of it was planted in Texas to produce rope fiber but before it was harvested and thoroughly tested the war was over. However, the re-

sults of what was done demonstrated that it could be economically produced and would be a very satisfactory substitute for sisal.

Okra can be grown in much of the United States and as it is an annual it must be planted each year. Two crops each year can be had. The fiber is long and light colored. It has a tensile strength somewhat less than that of sisal but its other physical characteristics are very comparable to manila hemp and other rope fibers. It, being a bast fiber, will require a different decorticator than the Sansevierias but the same type can be successfully used on it as is used for the decortication of hemp (*Cannabis sativa*). The soil requirements for its successful growth are not exacting as it will flourish on soils ranging from light sandy loam to muck. Naturally its growth is better and the yields are greater on the better classes of soils. A valuable food, very rich in vitamins A and B, is produced from the pod that can be canned, dried or mixed with other vegetables in soups. After the fruit is gathered the stalks are cut and decorticated and the fiber is ready for the market. There should be produced approximately 2000 lbs. of fiber per acre each year when it is planted to secure a maximum of fruit and when planted to secure the greatest yield of fiber there should be produced not less than 3000 pounds per acre.

Hibiscus Cannabinus

Hibiscus cannabinus, another of the Hibiscus group, has undoubtedly been the most utilized as a substitute for jute of any of the various plants tried. It has been grown in southern Russia for many years on a commercial scale and has been used very largely by them as a backing for their carpets and to replace jute in burlap. In fact Russia has made herself independent in the matter of jute production. The plant is indigenous to Asia but has been introduced in most parts of the world. It is an annual and reaches maturity in five months after being planted. Its soil requirements are the same as those mentioned under okra although it requires a

warmer climate and its distribution would be limited to the Southern part of the United States. The fiber is long, six to ten or more feet, silky, light in color and possesses about the same chemical and physical properties as does jute. It has been tried in this country and has been found to be entirely satisfactory. It is believed that seed for some considerable acreage can be secured from Brazil. Its productive capacity is the greatest of any of the fibers as there should be secured about two tons per acre per cutting with two crops easily secured each year. It is a bast fiber and would require the same sort of decorticator as the okra plant and requires no after treatment before being ready for the market.

Urena Lobata

Urena lobata is a native of the Western Hemisphere and grows wild in Florida where it is called Caesar Weed or French Cockle-Burr. It is a perennial bushy like plant which grows very rapidly from its roots when once cut to the ground. In fact two cuttings per year can be made after the first year. When planted close together by means of root cuttings it throws up long slender canes which are cut when the blossoms are at their prime. The fibers are long, light colored and silky. They are finer than those mentioned above and have been used in Africa and other countries as a source of fiber for the manufacture of rather coarse clothing. It is cultivated today on a commercial scale in Belgian Congo, Madagascar and many of the South and Central American countries. It has been tried by our jute manufacturers and found very satisfactory. Its soil requirements are not exacting and it should produce a minimum of 3500 pounds per acre per year. It is a bast fiber and the decortication machinery would be the same as used on common hemp. Root cuttings can be easily secured from the wild plants growing throughout Florida and a crop could be had in less than a year from the time of planting.

Although other plants could be discussed, such as Colorado River hemp, *Crotillarias,* the wild Hibiscuses

and Abutillon like plants growing wild, the four above mentioned have been chosen as they are the best known and have been most widely used either in this country or abroad. It is also felt that there is a possibility not only for their present day utility in our economic life as a source of raw materials but that perhaps some of them would serve a very useful place in our postwar economy as additional staple fibers. This especially applies to the Sansevierias and the Ambari hemp and to a lesser extent to Congo hemp. On the other hand it should be remembered that this has not been demonstrated although their value as a fiber material has been demonstrated. As a consequence of this uncertainty as to their long range utility, private interests are hesitant to invest in such developments and for this they cannot be criticised. It would seem to be the duty of governmental agencies to demonstrate and develop such fibers as are needed by our war industries and then to work out a practical program to subsidize or guarantee the private producer a just and fair income if he will raise the raw materials. It is felt that many farmers would be glad to plant any or all of these if they were shown how and were assured of a reasonable return for their labor and time. There should be no great difficulty in securing a sufficient quantity of these fibers in a very reasonable time if a serious and determined effort is made.

Wild stand of Urena Lobata

Value of Research Proved by Results in United Merchants & Manufacturers

Central Research Lab

THAT OLD ADAGE, "The proof of the pudding is in the eating thereof," has no better example than is afforded by the benefits that have accrued from their central research laboratory to the group of mills organized under the United Merchants & Manufacturers Management Corp. For the very good reason that this laboratory organization—somewhat unique in its conception and in the variety of its personnel—has produced notable although little-publicized results, the set-up and the way it functions are worthy of study. It may well serve as a model for adaptation to the broad requirements of the textile industry in general and any wide-awake group or unit in particular.

This research laboratory was organized to serve the needs of a group of textile mills, employing within the member group and affiliated mills most of the important processes of textile manufacturing from the processing of raw material to finishing, and by cotton, woolen and worsted systems. Included also is a subsidiary manufacturing chemicals and two complete inter-plant and inter-city power systems hooked up for both steam and hydro-electric power generation. A large variety of fibers is used in the mill products. These include synthetic and regenerated as well as cotton, wool, mohair and other hair fibers.

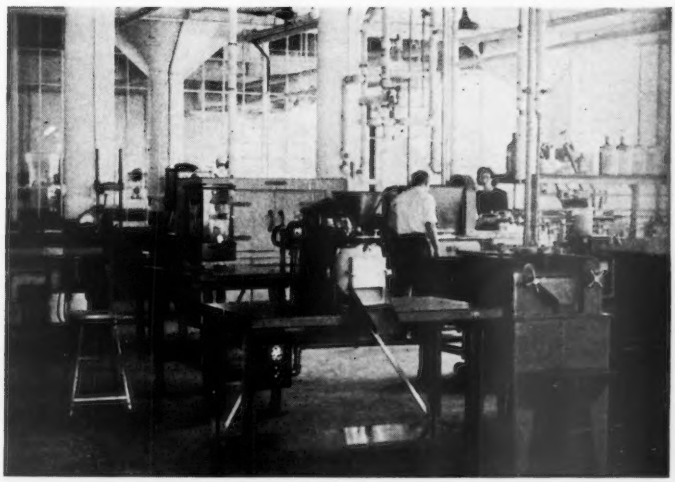
The accompanying organization chart is self-explanatory. It will be seen that there are a number of engineers whose functions have not usually been considered as coming under the heading of research, but, after all, the meaning of research is gradually assuming a broader

significance. Research combines with a study of underlying principles, the practical application of known fundamentals and new discoveries to the improvement of materials, methods, processes and costs.

It may not be an orthodox move but it seems logical to include metallurgical, steam, mechanical and electrical engineers in the research personnel of a textile organization, as well as specialists in different chemical fields such as pigments, plastics and finishes.

Power is one of the chief requirements of any manufacturing plant and its proper application and distribution can result in more efficient operation of the plant. Likewise, improvements in design and operation of the mechanical equipment frequently result in decided benefit. Plant surveys have resulted in suggestions that have eliminated many of the causes of costly break-downs that would interfere with production. Failure of equipment can be often laid to fatigue and chemical attack, and metallurgical and microscopic examination of surface characteristics and grain structure of particular materials has resulted in making it possible to recommend the

Section of lab.—United Merchants & Mfrs. Management Corp.



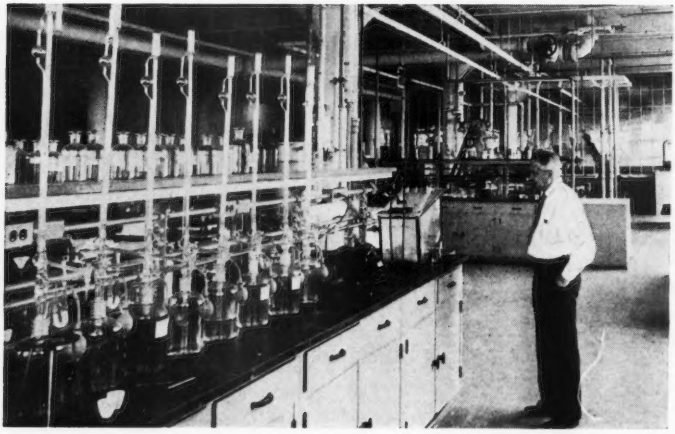
proper alloys to be used. An engineering division can be of great service in planning new operations, design of equipment for special purposes and in general testing.

There is a growing interdependendence of one industry on another, and it would seem obvious that the close cooperation possible through an organization of this kind should enable it to not merely take advantage of developments in all allied fields but to blaze new trails.

That the plan does work is proved by the results. One of the reasons for the successful functioning of this laboratory is that every man divides his time between the mills and the laboratory. The financial returns to the mills have been due not simply to a few spectacular accomplishments. Rather they represent the sum total of numerous small savings and in improvements in machine parts, improvements in processes and methods, improvement of product, and the development of new products.

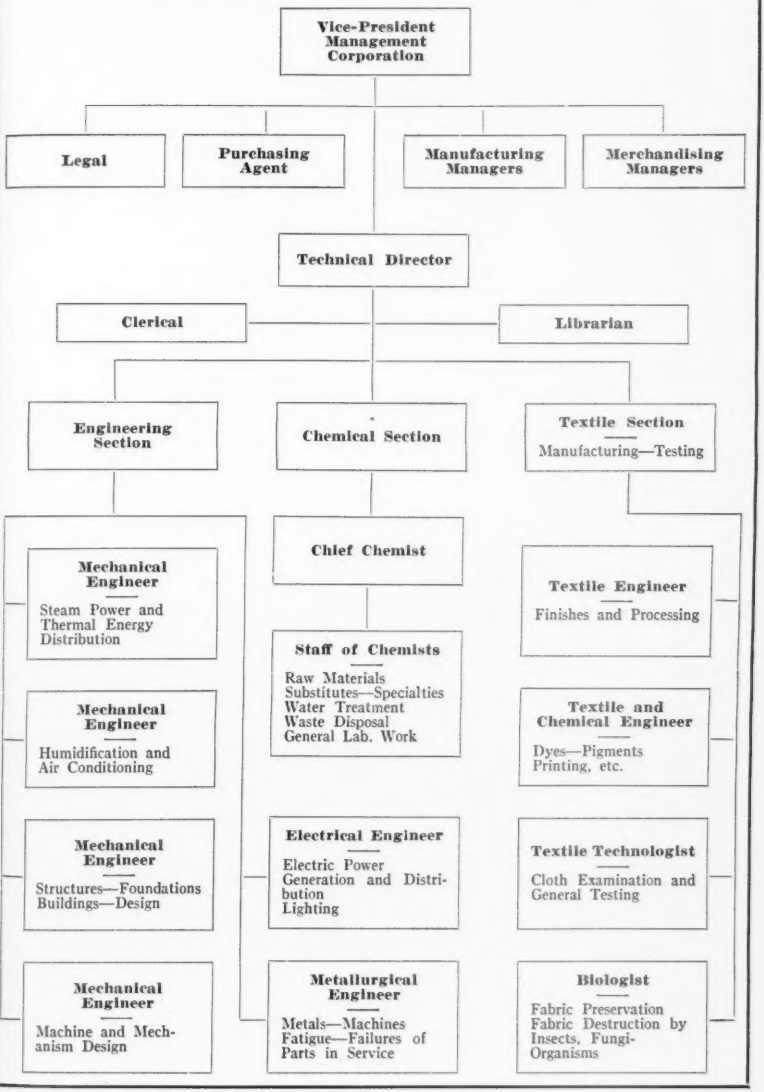
The laboratory was established two years ago with a small personnel. So satisfactory have been the accomplishments that it has been necessary to rapidly expand both personnel and facilities in order to meet the growing demand for service.

Section of lab.—United Merchants & Mfrs. Management Corp.



Organization of Central Research Laboratory

UNITED MERCHANTS AND MANUFACTURERS MANAGEMENT CORP.



RESEARCH ACTIVITIES

Under the Textile Research Planning Committee of the Quartermasters Corps of which Maj. S. J. Kennedy is Chairman, there is being set up a panel to study the question of the development and use of High Strength Cotton Yarns. One of the purposes of the panel is to consider the possibilities of making a stronger and more durable yarn, lighter in weight, which will enable lighter fabrics to be produced. Another study is the possibility of substituting cotton rope made from high strength cotton yarns for sisal. The first meeting was held, Monday, September 14. This meeting was attended by S. J. Kennedy; Milton Harris, Director of Research of the Textile Research Institute and the Textile Foundation; W. D. Appel, Chief of Textile Section, National Bureau of Standards; George R. Dugan and Herman D. Nichols of WPB Conservation Division; Ralph Butland and H. A. Secrest of the OQMC; A. Y. Willis, Jr. and R. J. Cheatham of the U. S. Department of Agriculture; R. F. Nickerson of the Mellon Institute; J. T. Wigington, Cotton Textile Institute, Clemson, S. C.; Albert Scott, president, Lockwood Greene; P. M. Collier, Callaway Mills; and A. W. Hansen of U. S. Rubber Company, New York.

"Textile Research in War," is to be the theme of the annual meeting of the Textile Research Institute, Inc., to be held at Hotel Roosevelt, New York, November 13. A session has been planned for the afternoon of that date, at which technicians and operating executives from all parts of the industry will discuss war research problems and the activities growing out of them. This technical session will be preceded by luncheon to be addressed by a prominent speaker from the field of research. The name of the

speaker will be announced shortly. In the morning a brief business meeting will be held for members. To make the discussions industry-wide in scope, both luncheon and the technical session in afternoon will be open to all engaged in the textile industry, whether or not members of Textile Research Institute. The Institute is particularly anxious to get full representation of technicians at the afternoon session. Those planning to attend should send in their reservations to the Institute's office, 10 East 40th St., New York.

A meeting of extreme interest and importance to textile men is to be held at the Hotel Roosevelt, New York, N. Y., November 5, 1942, 8:00 P.M. The subject of the meeting is, the cotton textile industry in Latin America. Mr. Albert L. Scott, president of Lockwood Greene Engineers Inc., is to give a survey of the entire cotton textile industry in Latin America covering raw materials, labor, technical progress, problems of financing, and related matters. Mr. Scott plans to give special attention to the growing cotton industry of Brazil. Cuba and Mexico will also be included in this survey. Any members of the textile industry who are interested in this subject will be welcome and any further information in regard to the meeting can be had from the research office of the Latin American Economic Institute, 429 West 117th Street, New York, N. Y.

Walter Krouse, textile microscopist, technical laboratories, Sears Roebuck & Co., was the speaker at a meeting of the American Assn. of Textile Technologists held in New York, September 16, 1942. Dr. Krouse discussed the four basic problems in fiber microscopy which are: fiber identification, quantitative fiber analysis, quality determination of the

RESEARCH ACTIVITIES

fibers, and identification of cause of damage in case of customer complaints.

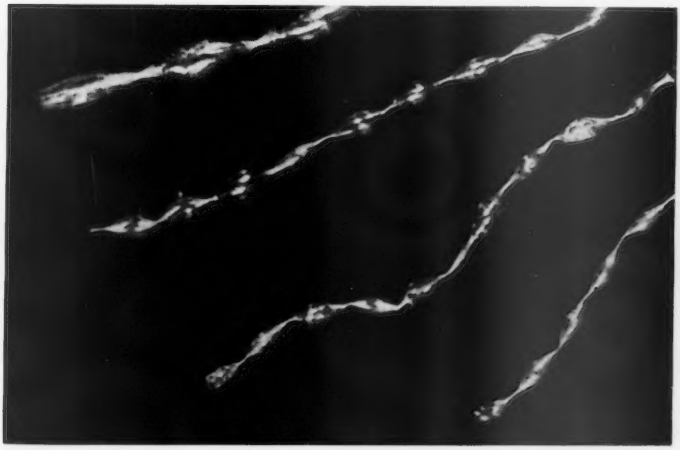
Ford Motor Company is continuing the development of synthetic fiber made from the soy bean. The Research Dep't states the fiber may be cut to desired length and ranges from 4 to 6 denier which is particularly suitable for blends with fine wool. The tensile strength at present is 80 per cent that of wool. This fiber may be processed on woolen, worsted or modified cotton systems. At present the Ford Co. is using a modified cotton system for making yarn containing 50 per cent wool and 50 per cent soy fiber as well as 100 per cent soy bean yarns. Low count yarns from 6's to 12's show better results than higher counts of 12's to 30's.

A luminescent coated fabric has been developed by Du Pont which glows with visible light in complete darkness, and is much cheaper than luminous paint. Exposure to electric light or sunlight for only thirty seconds is sufficient to give the coating the power to glow for a minimum of four to six hours, and may be renewed endless number of times by re-exposure to light. It may be cut into letters or strips to mark doorways, hand-rails, arm bands, tools and the like. It is easily applied to any type of surface and removed with ease.

A new product known as "Bubblfil" has been developed by Du Pont. It is regenerated cellulose made by the viscose process. The material is extended through a single spinneret hole of relatively large size and a small amount of air is injected into it at regular intervals just as the filament is coagulated by the acid bath. There are a number of outstanding characteristics of Bubblfil. It is fully as

buoyant as kapok and loses its buoyancy less rapidly upon prolonged immersion in water. When tightly packed it weighs about one and a half pounds per cubic foot and will support 20 to 30 times its weight of lead. It is tough and under laboratory tests equivalent to an altitude of over 50,000 feet, the bubbles did not explode. The resiliency of the cellophane bubbles has led to the study of the suitability as a shock-absorbing material. It might replace so-called "cellular rubber," a scarce material. The Bubblfil has been formed, by means of an adhesive material, into mats and cushions. These might be used for padding in airplanes or tanks. Bullets will not shatter them, leaving only small holes. Another important characteristic is its low thermal conductivity. Experimental fabrics have been woven, with a cotton thread for the warp and strands of Bubblfil in the filling. This extremely light weight material could be used as an interlining. Commercial sale of this material will have to wait on war necessities.

Slightly enlarged photograph of several strands of "Bubblfil" showing air-filled bubbles of cellophane.



Pulling Rabbits Out of the Hat

AN EDITORIAL

► Man's natural inertia and inherent resistance to new ideas have retarded progress.

► But even more unfortunate has been a too wide-spread lack of understanding of the functions and practical application of research.

► The spectacular achievements of the past have frequently led to a belief that—given a problem, some apparatus, and his choice of chemicals—the scientist could quickly concoct a magic brew with the aid of a few molecular incantations. But when a brand new product or process was not immediately forthcoming, the tendency has been to withhold further support.

► Although it is true that we are experiencing a breathtaking acceleration in revolutionary development—due in part to the stimulation of war necessity and partly by reason of the increasing numbers of trained workers engaged in the various fields of research—it should be recognized that the foundation for this accomplishment has been laid by the gradual accumulation of knowledge over past years. A foundation started by Henry Cavendish when he startled the scientific world by proving in 1784 that water is H_2O and opened the way for the atomic theory. A foundation periodically broadened with each succeeding major discovery and assisted by invention.

► Major improvements are preceded by laborious experiment and analysis and followed by further research in the development of their practical application. The classic examples of the ten years of continued experiment by Charles Goodyear before success crowned his efforts, and the ten years of experimental synthesis that preceded the advent of nylon are good illustrations. The

results of research are never had after the manner of the magician pulling rabbits out of his hat. The so-called lucky discoveries have been made by workers actively engaged in research.

The Future Course of Textiles

► The course of the textile industry is being profoundly altered by the product of the test tube. New chemical treatments are giving fabrics new uses, and processes are being revolutionized. Man-made fibers are replacing natural fibers in many directions and multiplying the variety of woven fabrics.

► There are being evolved new ways of using fibers without spinning or weaving and one of the major uses for cotton may be that of increasing the tensile strength of plastics.

► A way has been found to transform the molecular linkage of the wool fiber through chemical treatment, building a superior fiber, a fiber that is resistant to two of the worst destructive agencies, namely, attack by moths and by alkalies. And this treatment does not materially alter the softness or the strength of the fiber.

► The industry may be facing a future in which it is possible that little natural fiber may be used which has not previously been rebuilt to meet specific requirements. A very complicated future requiring infinite variety in selection and blending of fibers and in chemical treatments.

► It is certain that many textile manufacturers must adopt a changed viewpoint and not buck the current. Just as the metallurgical industry makes use of any of the available elements in adapting alloys to the ultimate uses of metallic products so will the textile manufacturer build his product to meet the specific requirements of the users.

Julian H. Jacobs

Clean Cotton Will Permit Heavier Feed and Higher Speeds Throughout and Yield

More Production From Cards

By M. A. Goldman*

On medium and coarse yarns a production of 20 pounds an hour can be expected from a cotton card. This rate of production has been obtained. However, in the reports published of tests run in this country and in England with increased speeds apparently little attention has been paid to the importance of suitable preliminary preparation of the cotton fiber with the result that a maximum production of less than 14 pounds has been had.

In processing cotton lint from the bale into yarn it is the thoroughness of the opening, cleaning and lapping operations that controls the production rate of subsequent operations. The carding machine is in principle a long draft reducing unit only. It is readily fouled and plugged by fibre fly, neps and foreign matter that enter with the lap. The function of the card being to orient the fibre and produce a uniform web, the practice of expecting it to function as the final stage in cleaning operations has been the chief factor in limiting its output.

The bat of cotton coming off of the screen of the finisher picker is the "ingot" from which the yarn is drawn. Open, clean cotton can be placed on the screen so as to form a sheet of uniform density. Such sheet can be extended by long drafts at high speed into the coarse and medium range of yarns to which cotton fibre has been relegated by the synthetic fibres. Cotton from the bale can and must be thoroughly opened and cleaned before being passed to the card. And the conventional

* Fiber Products Laboratory, New Brunswick, N. J.

opening room machinery can be operated to do this. These machines have lower fixed charges, lower power consumption, lower use maintenance cost, lower payroll, lower operating cost per pound of production than the machinery of the subsequent operations. The passing of part of the opening, cleaning and evening work into subsequent machinery is a major cause of the "out of line" high cost of manufacturing of cotton textiles.

A Heavy Lap is Required

A large supply furnishes a uniform feed to high speed long draft. An eighteen ounce lap presents a larger area to the lickerin than a twelve ounce lap and therefore is advanced into the lickerin at a proportionately lower speed and pressure for a required feed. Each lickerin point at higher speed enters the lap more times per minute and works in more cotton, thus providing more time to find and draw free fibres. In each pass the point picks only a fraction of the fibres that it would be obliged to pick from a twelve ounce lap at conventional slow speed. This eliminates the cause for "plucking" and the resulting "flaky" web and "nubby" yarn.

The possibilities of long draft machinery should be utilized throughout carding, drawing and roving. An extra heavy picker lap can be long drawn to an extra large sliver which in turn is a large "supply" to the roving frames. There again with long draft there is drawn a large size roving for long draft spinning. This increases the pounds per machine hour to supply spinning.

Certain engineers are working to develop the practice of cleaning the cotton before it reaches the carding machine. Others are working to develop cleaning attachments for the card. The result of either endeavor will be more pounds of roving per hour from the same equipment. Furthermore, the conventional opening and cleaning machinery does not remove all the cotton fly and very short fibre. These deposit in the clothing of the cylinder and flats and should be removed by a continuous means in order to insure uniform free action of

the clothing. This is in practice in many mills.

The important work of the carding machine is done between the feed roll, feed plate and lickerin. The "wrongs" at this end pass along to the web off the doffer. The draft between the feed roll and lickerin should be more than 2000. The draft between the lickerin and cylinder should be less than one and one half. The draft between the feed roll and doffer should be more than one hundred.

The uniformity of the structure and the orientation of the fibres of the web off the cylinder is accomplished in the action between the cylinder and the flats. There is an optimum thickness of cotton that can be effectively acted upon in this operation. This optimum should be maintained, to insure the quality of the web, irrespective of changes of speed for increased production. Lickerin and cylinder should be balanced statically and dynamically and run in lint-sealed anti-friction bearings for speeds of more than 750 and 225 R.P.M. respectively. The air currents can be controlled and used to advantage.

Testing for coincidence of the axis of rotation with the principal axes of inertia should be done after the card is clothed, ground and located on the floor. In order to overcome vibration that may be due to indeterminate factors and to live load, flexible elements may be introduced between the card and the floor which will effectively reduce the transmission of vibration.

The centrifugal force within the range of carding speeds is not a critical factor. The effect on the fibre can be disregarded in view of the lightness of web, low peripheral speed and large diameter of cylinder. Proper tension of the clothing should inhibit any tendency to ballooning within the speed ranges anticipated. The deformation of the clothing in relation to the cylinder is caused mainly by the working load and other effects are negligible in comparison. The flats should be run in counter direction of the cylinder so that the web will travel into cleaner pins and leave from a clean flat.

RESEARCH AIDS

Technical and Commercial Dictionary of Spanish*

Of special importance in the fast growing commercial and social relationship of the nations of the Americas is an understanding of one another's language. Embarrassing misinterpretations frequently occur in hazy letters which attempt to bridge the gap between the languages and may result in loss of business and good will. A dictionary that has just been published containing some 50,000 words used in commerce, science and engineering fills a gap in available dictionaries dealing with the Spanish language and should be in the library of every business executive and technician. The work was compiled by a prominent Spanish engineer and translations are in accordance with the latest rules of the Royal Spanish Academy of Languages.

The arrangement is in three parts. (1) Spanish-English; (2) English-Spanish; (3) Conversion tables of weights, measures and monetary units.

* New Commercial and Technical Dictionary by Antonio P. Guerrero. Chemical Publishing Co., Inc., 234 King St., Brooklyn, New York. DeLuxe Edition, Thumb Indexed, Flexible Binding, 600 p. $10.00.

Electron Microscope for Diffraction Patterns

It is understood that an adapter for the electron microscope is being developed by the R.C.A. Laboratories. It will be interchangeable with a section of the present tube and will make it possible to photograph a diffraction pattern of the specimen under examination. This promises to widen the usefulness of the electron microscope as a means of analyzing structure. The field of textile fibers is beginning to be explored. A major obstacle in this field is due to the comparatively large diameter of textile fibers and the tendency to char because of the heat produced.

Du Pont Peace-time Research Has Led to Development of

Fabrics for War

By STEPHEN M. SPENCER*

RESEARCH IN AMERICAN laboratories and mills has equipped the fabrics of war with chemical "armor" enabling them to resist fire, water, Arctic cold and tropical sun. Indicative of the initiative of American chemists is the fact that most of the treatments and coatings now proving so valuable in the war were contributions of peace-time research.

One of the most interesting of these developments is the use of the ammonium salt of sulfamic acid as a fire-retardant. Although the acid had been known since 1879, when the Swedish chemist Berglund discovered it, it did not become available in quantities until six years ago. Chemists of the Du Pont Company's laboratories, at the time working on another problem, devised a new and practical process for manufacturing sulfamic acid from urea and fuming sulfuric acid, mixed at closely controlled temperatures.

Among the properties revealed by experiments to find uses for sulfamic acid, one of the most striking and useful is its ability, in the form of ammonium sulfamate, to flameproof fabrics rendering them incapable of supporting fire. The cloth or garment to be flameproofed is dipped in a water solution of ammonium sulfamate and allowed to dry. The treatment does not alter the appearance or feel of the fabric. To obtain the maximum effect, the fabric should be dry before dipping.

In ordnance plants, shipyards, steel mills, oil re-

* E. I. duPont de Nemours & Co., Inc.

fineries and other production centers where there is a possibility of clothing catching fire, the workers are protected by fabrics rendered fire-resistant by ammonium sulfamate. A Philadelphia company whose acetylene welding department is operated by women is protecting them not only with flameproofed gloves and aprons but by a specially designed and flameproofed headgear to guard their hair against flying sparks. Air-raid wardens' coveralls and gloves are being so treated, and the Army and Navy are using quantities of the chemical to treat fabrics which might be exposed to fire, although the details of the military applications are secret.

Moving from fire to water, we find a variety of water-repellants developed during the past few years are receiving wide application in military and work garments. They are particularly useful where a degree of protection is desired without sacrificing lightness and porosity. Not only clothing but such

This woman war worker is specially clad in new type fabric glove, apron and cap treated with fire-retardant chemical manufactured by du Pont.

Courtesy du Pont

items as machine gun belting are being treated with water-repellants. For some applications a so-called "three-way fabric," made resistant to fire, water and mildew, has been developed. The weakening effect of mildew in mine conveyor belts is being effectively combatted by treating the belting fibers with a mildewproofing compound. And sandbags for revetments to protect anti-aircraft gun crews are treated with copper naphthenate to prevent similar deterioration by the fungus growths.

In the field of non-porous waterproof materials, the coated fabrics employing pyroxylin or vinyl resins are playing a very important part. Their usefulness is particularly appreciated in the presence of the acute rubber shortage. Raincoats for the Army, Navy and Marine Corps, for example, are being made of vinyl coated fabrics, which are fully equal to rubberized fabrics in performance. The Army raincoats have the vinyl layer on the inside, to avoid the shininess which might reveal the soldiers to the enemy when the coats are wet. The proposed new specifications for raincoats for the Navy and Marine Corps will provide for two layers of cloth with the vinyl plastic layer laminated between them. The seams may be made by one of three methods—cementing, stitching and strapping, or stitching and painting. Where a single layer of cloth is used with the coating on one or both sides, the seams may be made by wetting the edges with a solvent and pressing them together.

Soldiers' food and clothing bags, ground cover cloths to protect sleeping bags from dampness, and a variety of coverings and paulins for guns, signal apparatus and other military equipment are being made of coated fabrics, either the pyroxylin (cellulose nitrate) or vinyl resin type. The leatherette type of pyroxylin coated fabric is being made up into dispatch cases for the military and a white leatherette is being used for many of the Civilian Defense armbands.

The difficulty of providing suitable coated fabric

articles for the armed forces is appreciated when it is considered that troops are being sent to battle zones and outposts in the four corners of the earth. Clothing and equipment must be provided, therefore, to withstand all kinds of climatic assault from the snow, ice, and sub-zero temperatures of Iceland to the blistering sun and sand of Egypt and the heavy humidity of the Pacific Islands.

A neoprene-impregnated fabric, sold under the name of P.A.W. sealing tape, is being extensively used in war construction plants to make water-tight joints and seams in sheet metal work. Somewhat resembling ordinary electrician's friction tape but thinner and without the tackiness, the P.A.W. tape has a layer of dry cement on each side. This is moistened with kerosene, benzine or other light oil just before the tape is applied to the metal. After the upper surface is similarly mois-

What the well-dressed warden wears. Complete flameproof costume.

Courtesy du Pont

tened the second piece of metal is pressed on and clamping, drilling and riveting can then proceed. In the aircraft and shipbuilding industries this new tape is helping speed construction and is providing a seal which is resistant to sea or fresh water, gasoline, oil and common cleaners. It is used to insulate dissimilar metals from one another and thus prevent destructive electrolysis, and it inhibits corrosion and oxidation.

Fabric impregnated with neoprene is also made into carburetor diaphragms, oil seals, valve seats, gaskets, shock mountings and other parts in airplanes and tanks.

Importance in Dyes

Dyes are important, too, in the preparation of war fabrics, for the very life of the soldier, and indeed, sometimes the outcome of the raid or battle may depend upon the effective concealment provided by the drab color of his clothing. The uniforms of World War I were notoriously poor in respect to dyes. They faded out to a yellowish-white, one of the most conspicuous of all shades. But the growth of the American dyestuffs industry since that time has enabled the American soldiers, sailors and marines of World War II to wear uniforms dyed with fast colors, colors that won't fade.

In this connection, the Du Pont company, which has been a leader in developing the American dye industry, has recently brought forth a new method of bleaching which insures more rapid production of a uniformly bottomed piece for the dye and thus a more even dyeing. This is a continuous process using hydrogen peroxide as the bleaching compound and is the first successful effort to get away from the traditional batch process of bleaching. No small part of the contribution is the reduction of bleaching time from 8 to 10 hours to two hours.

Improvements in synthetic fibers and addition of new ones have been of great benefit to the war effort. Nylon's shift from women's hosiery to parachute fabrics, shroud lines and harness webbing, is well known. It is

doing an excellent job and is destined for many additional military applications in the near future. High-tenacity rayon, brought to the state of commercial production less than ten years ago, is going into tire cords for bombers, jeeps and army trucks, where its superior strength under the high heat of heavy-duty driving is of inestimable value. Rayon cords also save appreciable quantities of rubber by permitting the tire walls to be thinner and by adding life to the tire. High-tenacity rayon is also being made into flare parachutes, used to illuminate a target or landing field, and for cargo 'chutes.

Back of all of these things which have made textiles more useful to a nation at war is the research man and the research-minded industrial leader, men with imagination, originality and the determination necessary to convert an idea into a reality.

One-piece wrap around "Coverall" made of closely woven cotton poplin treated with Zelan durable repellant. Finish stands repeated washings and dry cleanings.

Courtesy du Pont

Comparison of Laboratory Tests with Actual Wear Performance Indicate Need of More Rigid

Tests for Colorfastness

COMPARISON OF THE ACCURACY with which laboratory tests predicted actual wear performance in service is reported in Part 2 of a report which appears in the October issue of *Journal of Home Economics* under the title, "Colorfastness of Women's and Children's Wearing-Apparel Fabrics." This report covers some of the findings of Northeastern Regional Experiment Station Co-operative Textile Project under the direction of a committee of which Prof. Pauline Beery Mack is chairman. During the past 7 years, 1000 colored fabrics have been given laboratory tests and 211 worn out garments, for which consumer records have been entirely adequate, have been returned for inspection together with enough consumer data for making comparisons with laboratory tests. Comparison of the results showed that fabrics of cotton and linen showed a greater loss of color under actual service than had been predicted by standard laboratory laundering tests in from 75 percent to 86.2 percent of the fabrics tested. The variation being due to the type of laundering test. The wear performance of all fabrics showed greater loss of color than was predicted by standard 40 hour Fade-Ometer tests for colorfastness in 38½ percent of the tests. In the remaining percentages given in both of the above cases the laboratory tests either equalled or exceeded the wear tests. Test results are given in the accompanying table.

The conclusions are that laboratory tests should be devised that would come a little closer to duplicating the results of actual service. In the case of the test for

colorfastness to light, as an example, the method of conducting the test was satisfactory, but a longer period of light exposure seemed desirable. In the case of the laundering test, a number of successive applications of the present test, or else an accelerated one-wash test giving the equivalent of a multiple-washing test would be indicated.

The laboratory tests of too mild a character would quite obviously be more serious from the consumer's point of view than would those which are too rigorous, since she wants to be warned of all potential causes of color damage, some of which may be prevented by careful treatment.

A comparison of laboratory and wear performance of 211 garments with respect to colorfastness

TEST	FABRICS SHOWING LABORATORY TEST SAME AS WEAR PERFORMANCE	LABORATORY COLORFASTNESS PERFORMANCE TESTS	
		More rigorous than wear tests	Less rigorous than wear tests
	per cent	*per cent*	*per cent*
Laundering			
Of cotton and linen			
Test I	12.5	1.3	86.2
Test III	13.7	1.3	85.0
Test IV	18.7	6.3	75.0
Of fabrics other than cotton and linen	32.4	11.8	55.8
Dry cleaning			
Dry method	78.5	1.8	19.7
Wet method	35.7	50.0	14.3
Light	49.0	12.5	38.5
Perspiration			
Acid	59.5	21.0	19.5
Alkaline	56.0	25.0	19.0
Crocking			
Dry method	73.8	26.2	0.0
Wet method	25.1	74.9	0.0
Pressing			
Dry method	85.5	14.0	0.5

Arthur Besse in Letter to the Editor Takes Issue with Alvin H. Hansen on

Postwar Full Employment

The September issue of Textile Research contained a condensation of a pamphlet issued by the National Resources Planning Board, entitled "After the War—Full Employment." We published this because we know that Dr. Hansen's ideas are given considerable weight by men in authority in Washington, and for that reason we felt they should be brought to the attention of our members.

Arthur Besse, president of the National Association of Wool Manufacturers and one of our Directors, disagrees with many of Professor Hansen's conclusions. We, therefore, were glad to offer him the opportunity of expressing his views. (Mr. Besse's letter follows.) Editor.

UNDOUBTEDLY THE PURPOSE in devoting so much space in September *Textile Research* to a review of Dr. Hansen's article was to emphasize the importance of planning for the postwar period. The natural inference to be drawn from the review, however, is that Dr. Hansen has made a substantial contribution to thinking on that subject.

This I believe is open to argument. I also take issue with the statement that numerous revisions were made in the text as a result of suggestions from businessmen, economists and labor leaders. Having compared the preprint with the final opus, one wonders why it was thought worth while to go through all the motions of making such a wide-spread distribution of the preliminary draft.

The idea of full employment is one to which we can all subscribe, but unfortunately Dr. Hansen does not suggest means which seem at all adequate to attain this ideal. On the contrary, it is my opinion that he is attacking the

problem at the wrong end. Full employment does not, as Dr. Hansen appears to believe, automatically provide a distribution of wage payments sufficient to purchase the growing products of such full time operation. If it did, why was there a recession in 1929? Plainly the trouble is elsewhere.

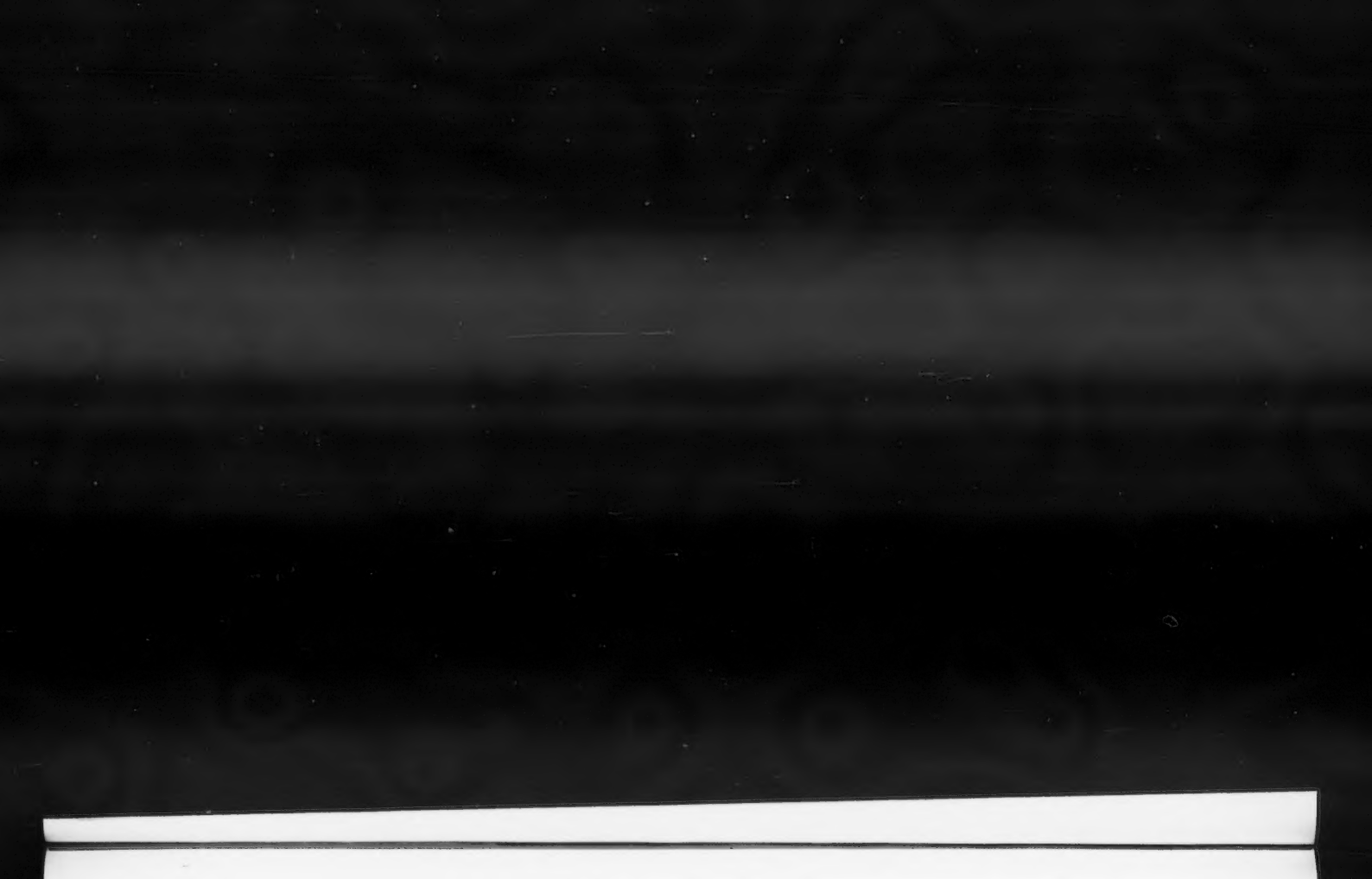
The problem of postwar planning is to create an effective demand to replace the larger demands which occur in periods of war or of industrial booms. These more or less temporary demands should somehow be replaced by an effective demand considerably larger than what has hitherto been considered normal for a peace time economy. This is a problem of distribution, not of production. Full employment is the result, rather than the cause of such a demand. The only way it is really possible to define "full employment" is in terms of the satisfaction of current needs. Full employment may mean a 30 hour week, a 40 hour week, or a 48 hour week, according to the number of hours it takes for all employable persons to produce with existing equipment the things we may currently demand.

Dr. Hansen does not define "a program of full employment," but appears to contemplate "made" Government work for those not employed in private industry since he refers to the necessity for "government expenditures" in this connection. There is little doubt that this will be necessary although there may be a limit as to the extent to which this is financially possible.

Dr. Hansen appears to believe that there is no actual limit to a Government's internal debt. Few will share this opinion. Nor is one impressed by an analysis of some of the financial slight of hand operations which Dr. Hansen mentions in connection with Governmental fiscal policy. He suggests that the postwar transition to increased civilian consumption is to be accomplished by (among other things) the "sale of defense bonds" a "shifting of money spent from defense bonds to consumption" and "an enlarged program of Federal ex-

penditures." This suggestion can, from an aggregate point of view, be accomplished only if the Government is reducing its expenditures and its borrowing and is retiring its funded debt.

Yet Dr. Hansen proposes at the same time large investment of private funds in industrial enterprises, reduction of certain taxes, and "an enlarged program of federal expenditures." There seems to be a grand jumbling and intermixture of credit and debit items in his financial utopia. From the civilian point of view, how can the individual (meaning the aggregate of all individuals) put his money into new industrial enterprises if the situation is such that he must sell his defense bonds to obtain money to buy the goods we are to make for him. From the government point of view, how can the Federal Treasury redeem defense bonds, reduce taxes, and finance an enlarged program of federal expenditures all at the same time. The steps suggested are individually possible, but cannot be taken concurrently.

As for Dr. Hansen's sixth suggestion, I am sorry to see that he makes common cause with those who look at foreign trade as a means of finding outlets for surplusses which we ourselves do not want. Except to the extent to which we wish to be international philanthropists after the war, foreign trade cannot be considered as furnishing a dumping ground for our excess products. It should be viewed *solely* as a means whereby we may *import* what we need and do not have. Unless we have needs which must be satisfied by foreign countries, we can only receive in exchange for the surplusses which we do not need, other things which we do not need either, or credits upon which we cannot realize.

The two most dangerous dogmas current today are: (1) The theory that there need be no limit to internal borrowing, and (2) The idea that foreign trade has a virtue other than to supply ourselves with items we cannot produce in this country. Dr. Hansen appears to believe in both of these doctrines.